

FIG. 2

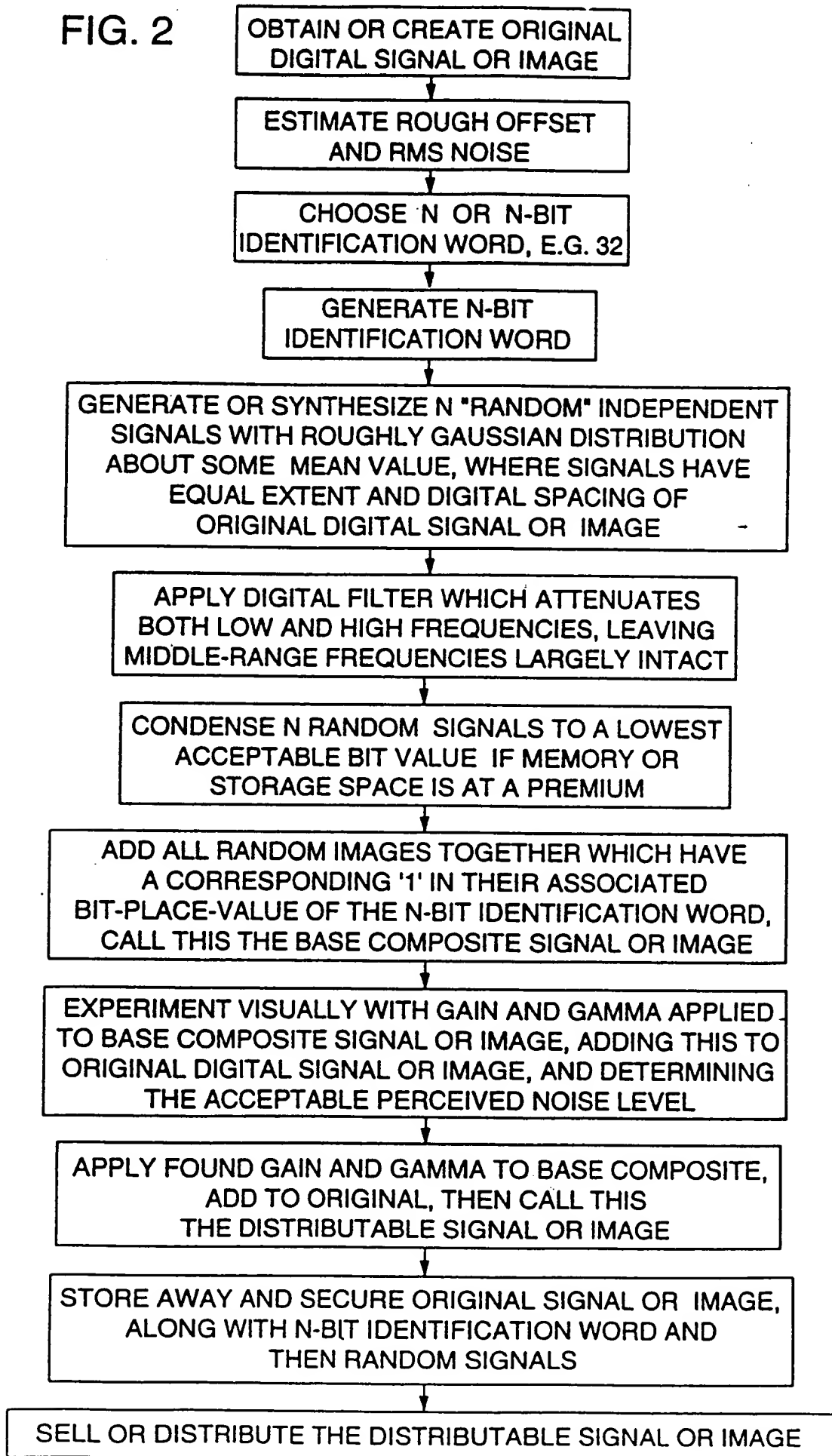


FIG. 3

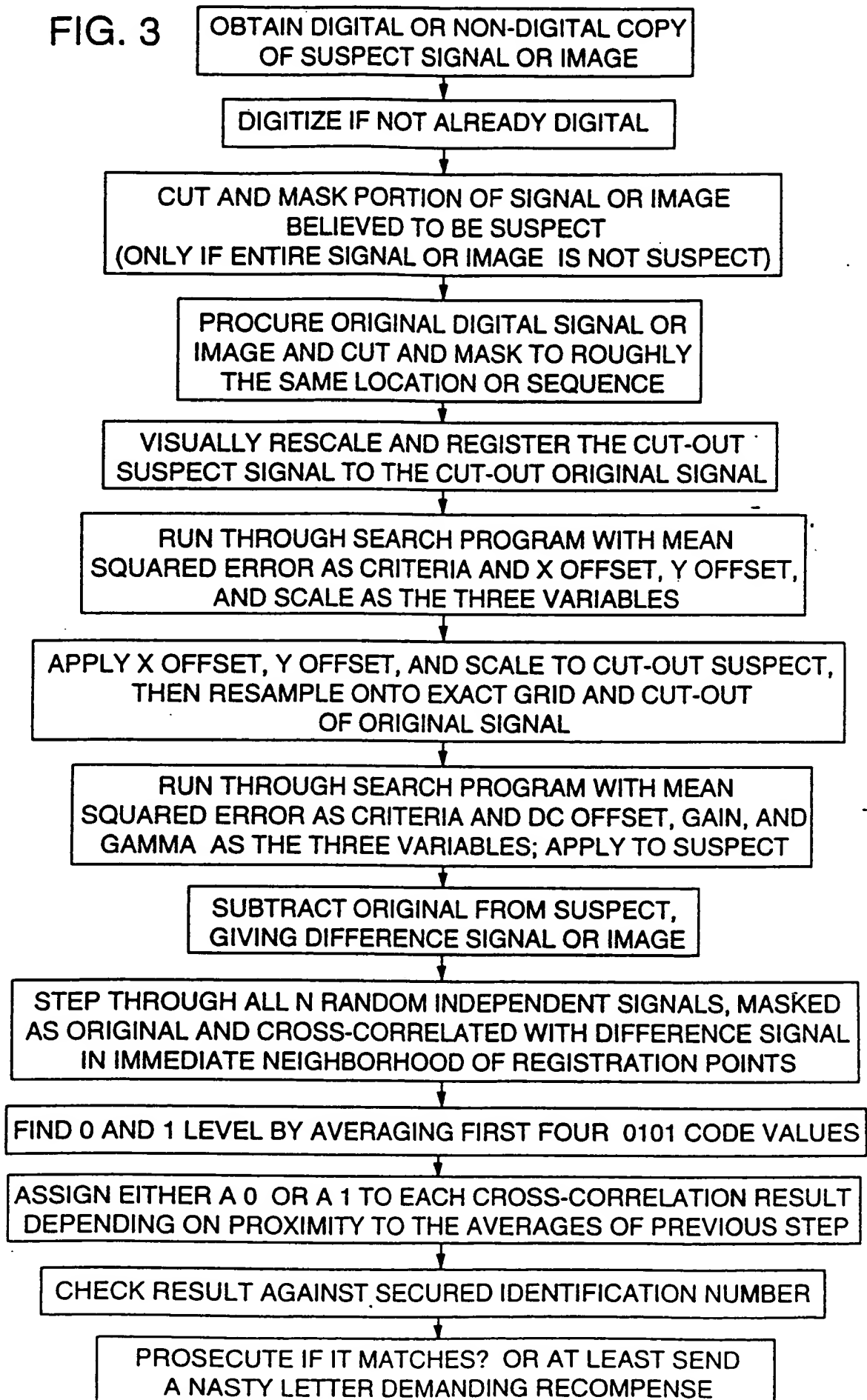


FIG. 4

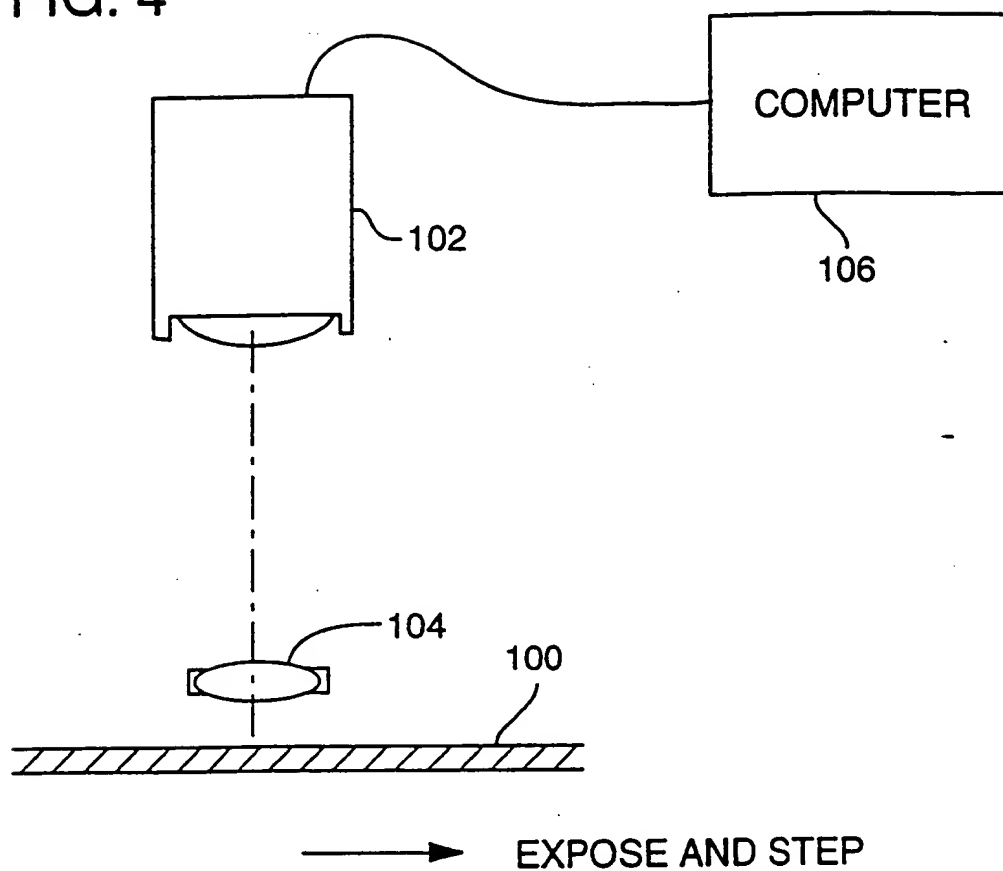


FIG. 1

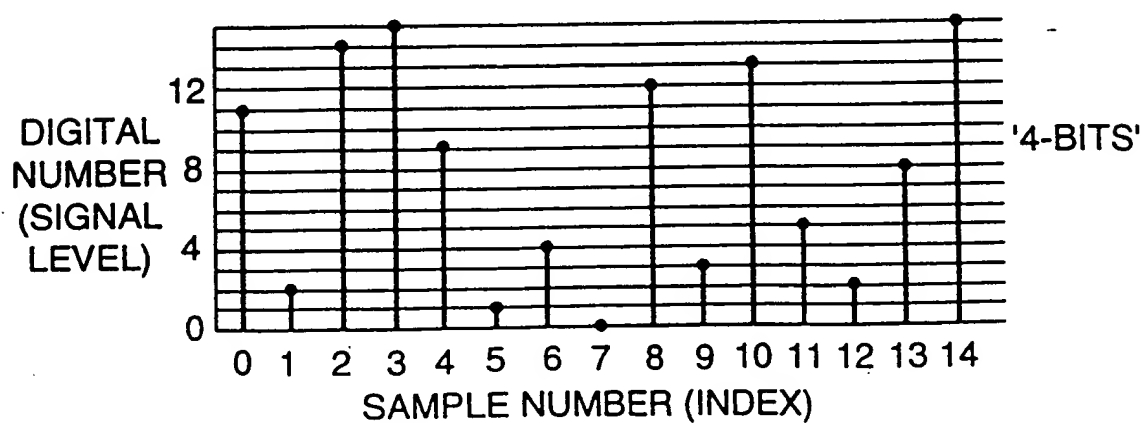


FIG. 5

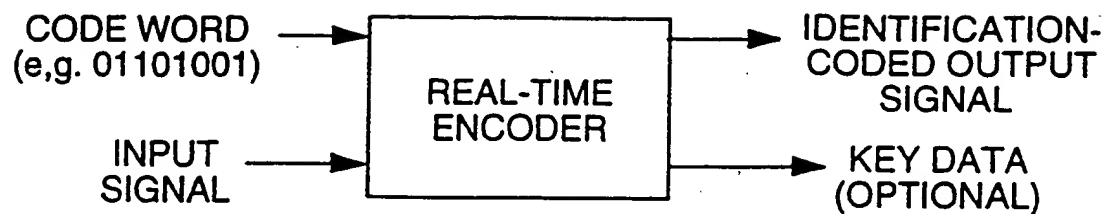
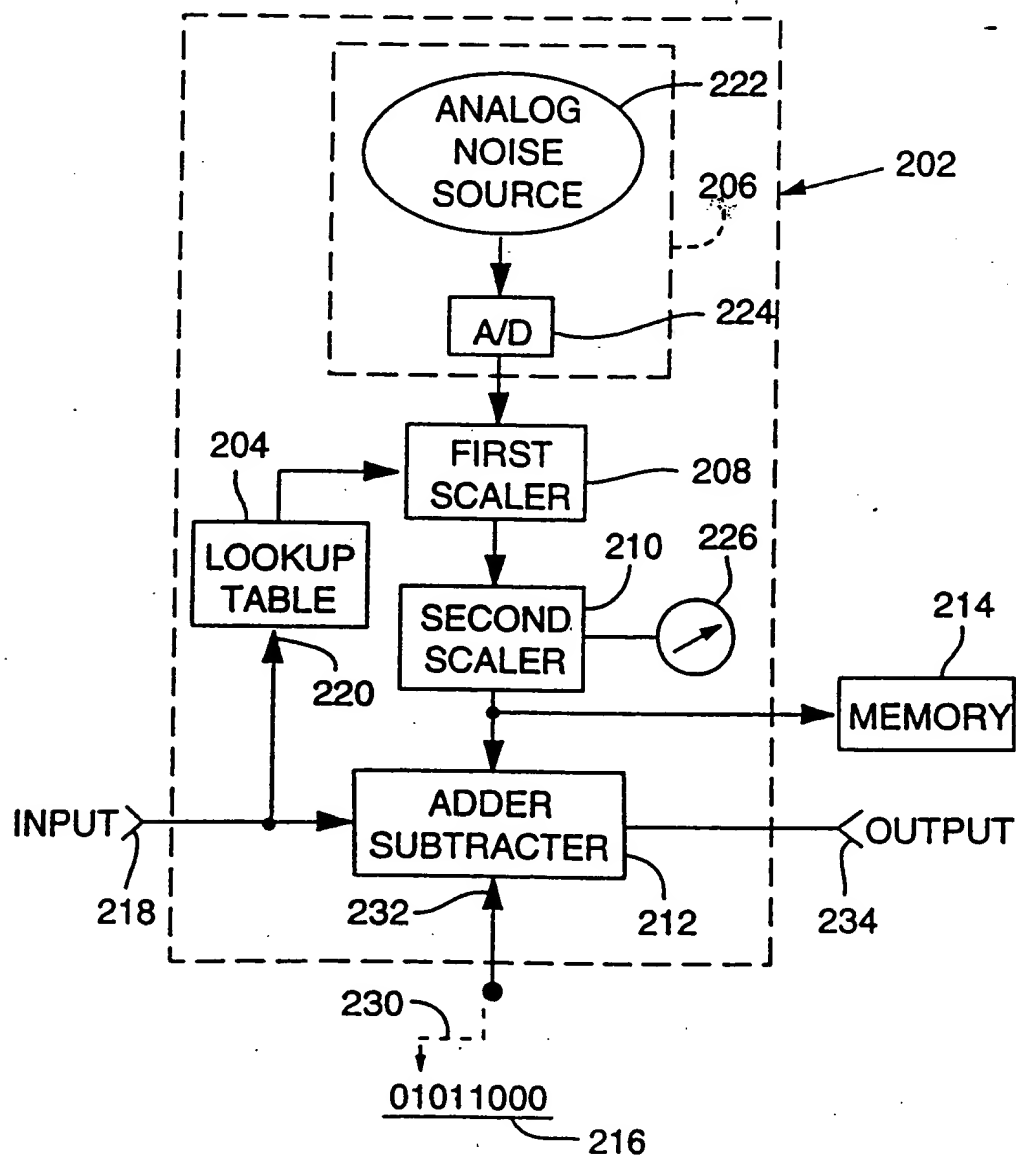


FIG. 6



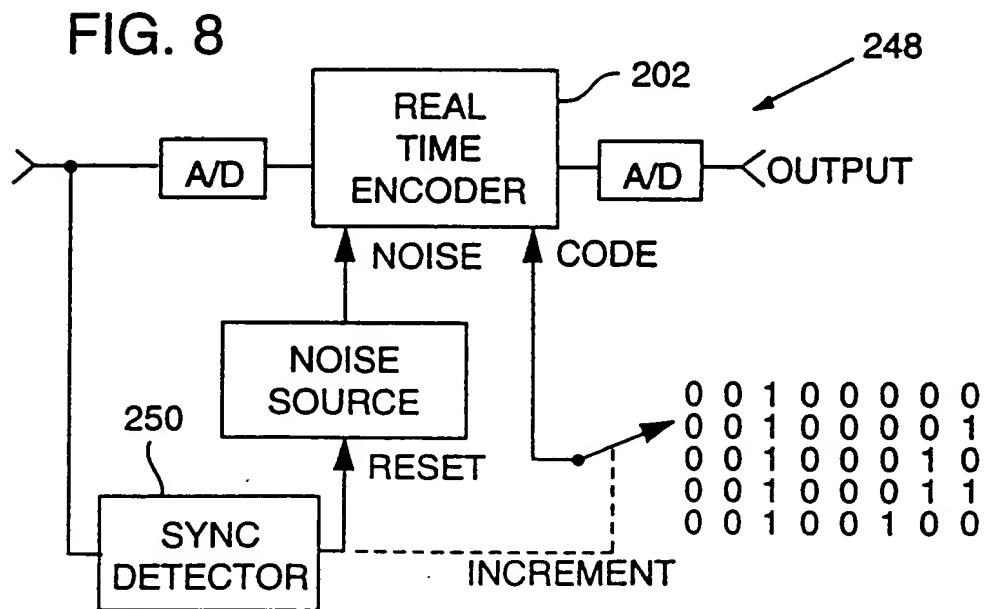
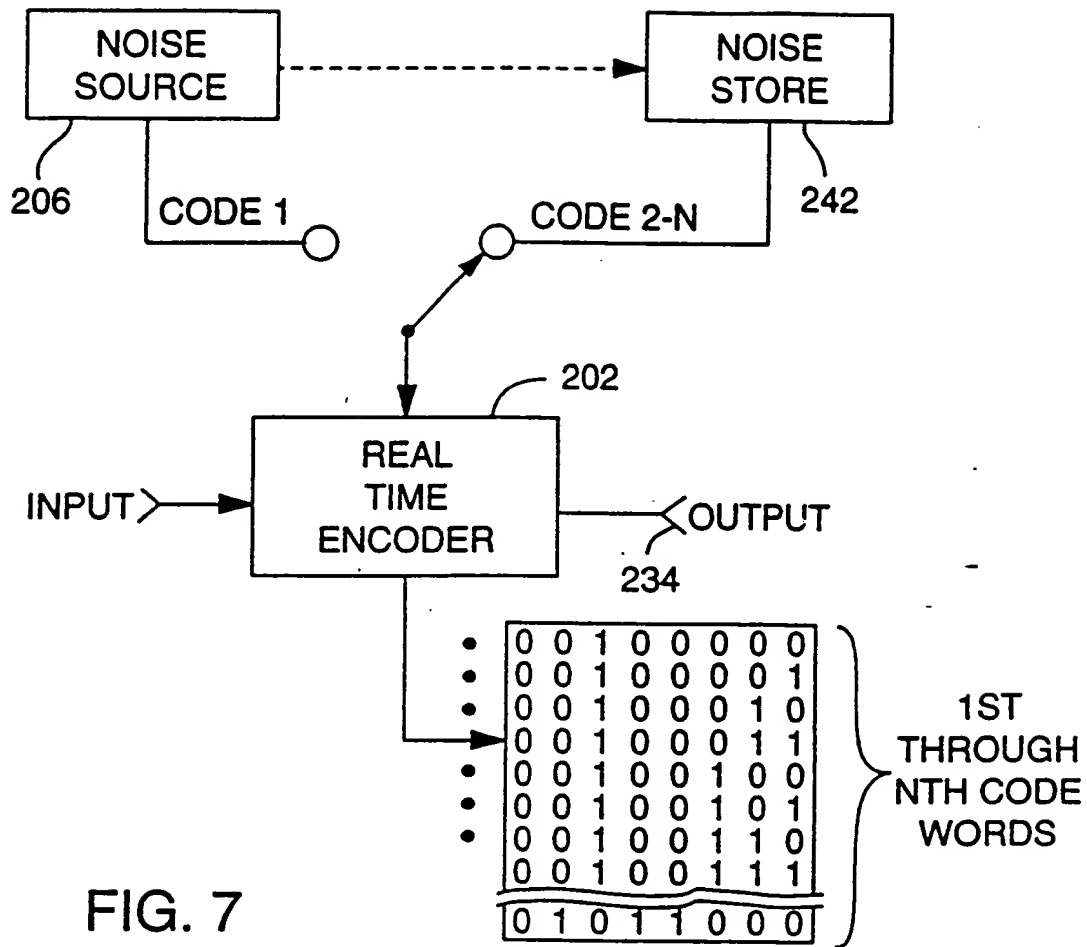


FIG. 9A

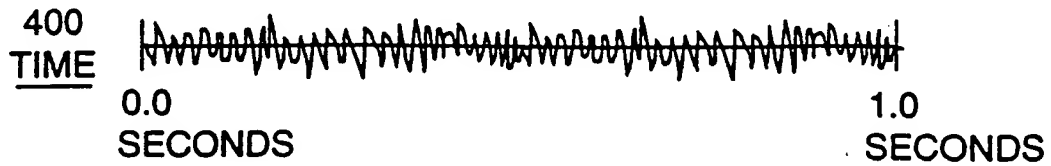


FIG. 9B

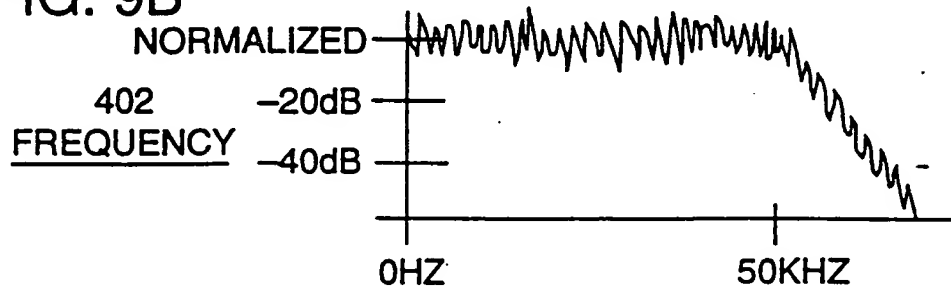


FIG. 9C

BORDER
CONTINUITY
404

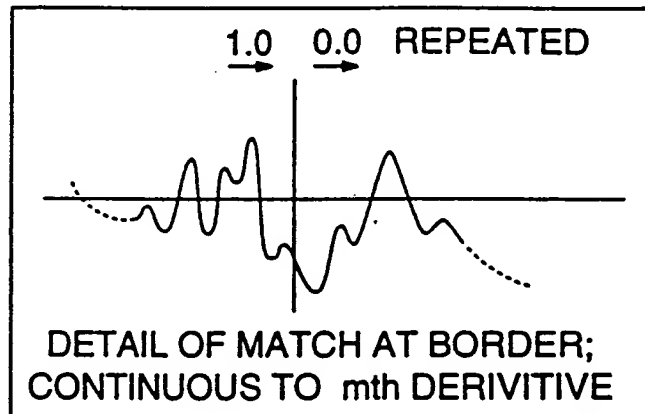


FIG. 10

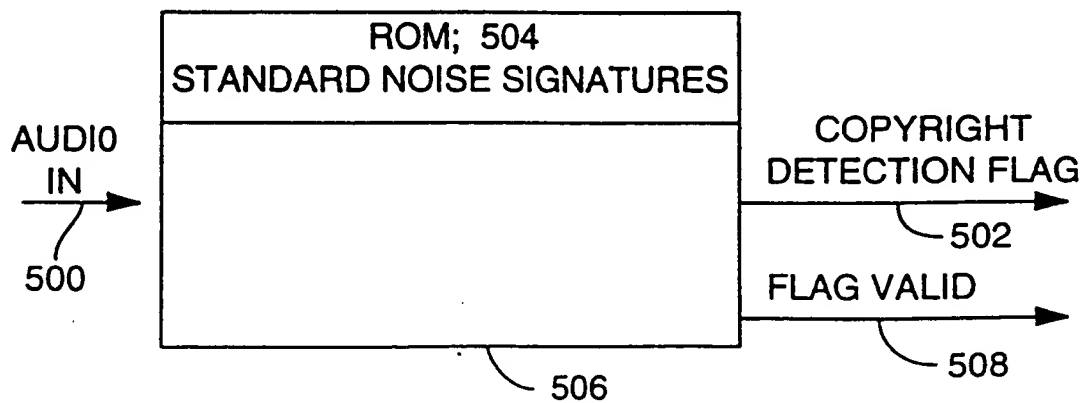


FIG. 11

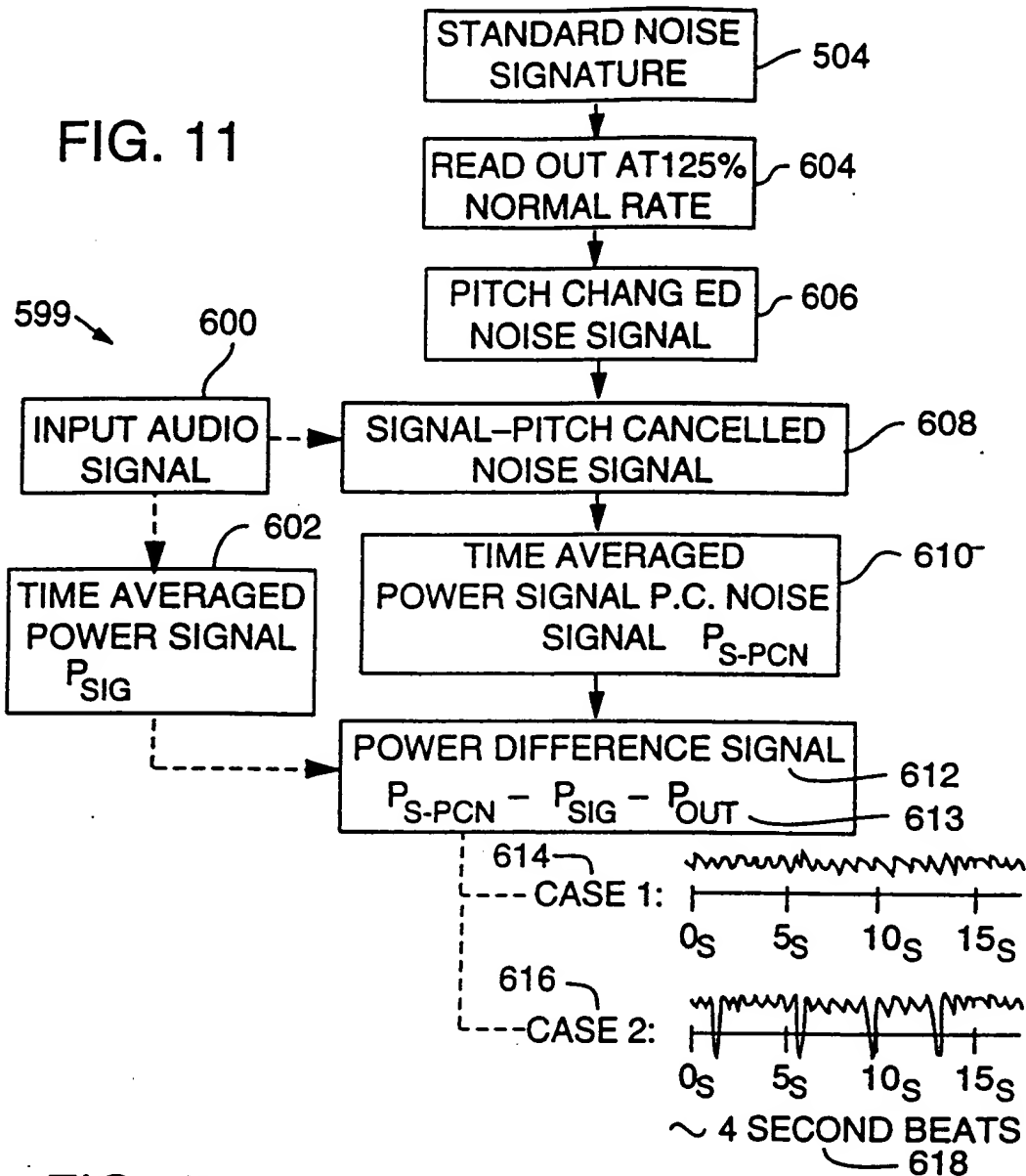


FIG. 12

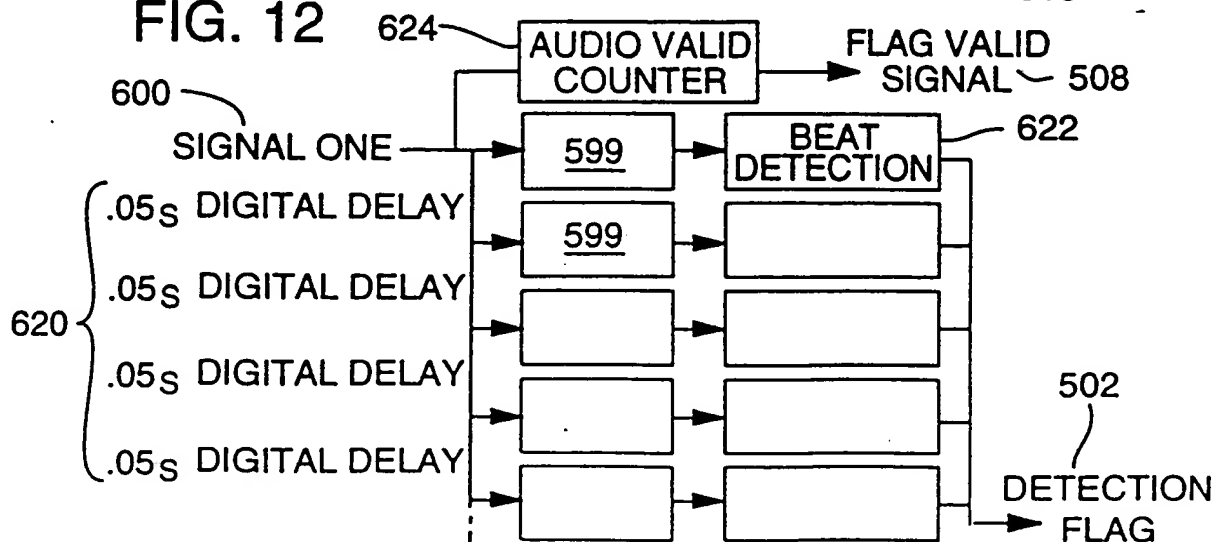
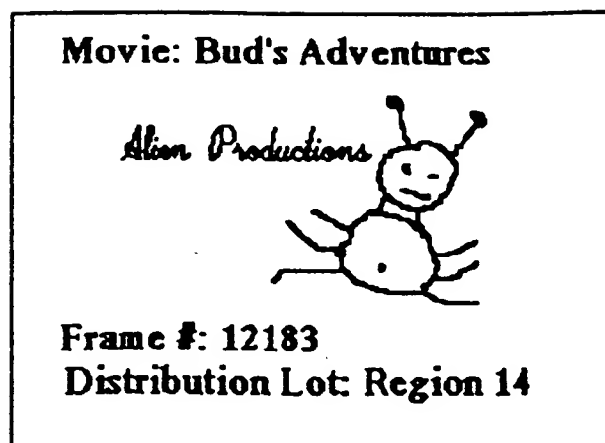


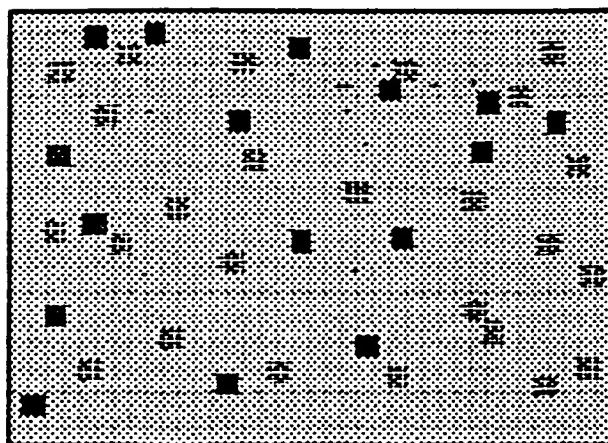
Figure 13



700

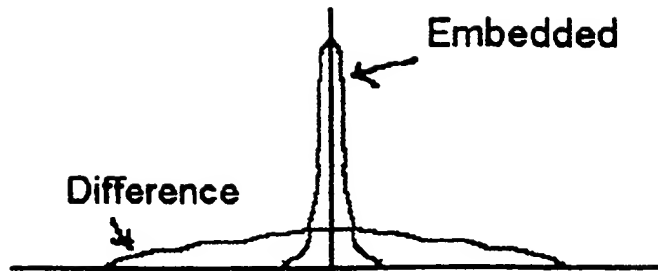


Encryption/Scrambling
Routine # 28 ,702

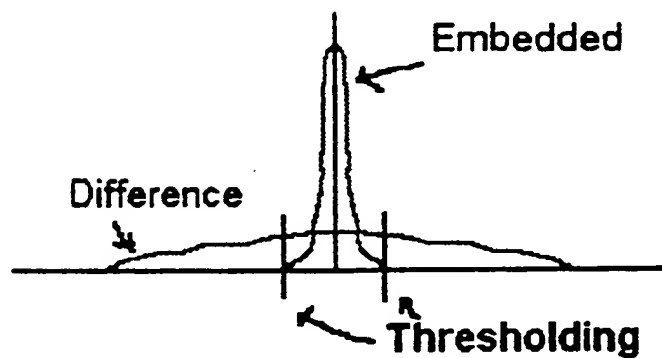


704 **Pseudo-Random Master Snowy Image**
(Scaled Down and Added to Frame 12183)

Figure 14



**720, Mean-Removed Histograms of
Difference Signal and Known Embedded
Code Signal**



**722, Mean-Removed Histograms of
First Derivatives (or scalar gradients
in the case of an image)**

Figure 15

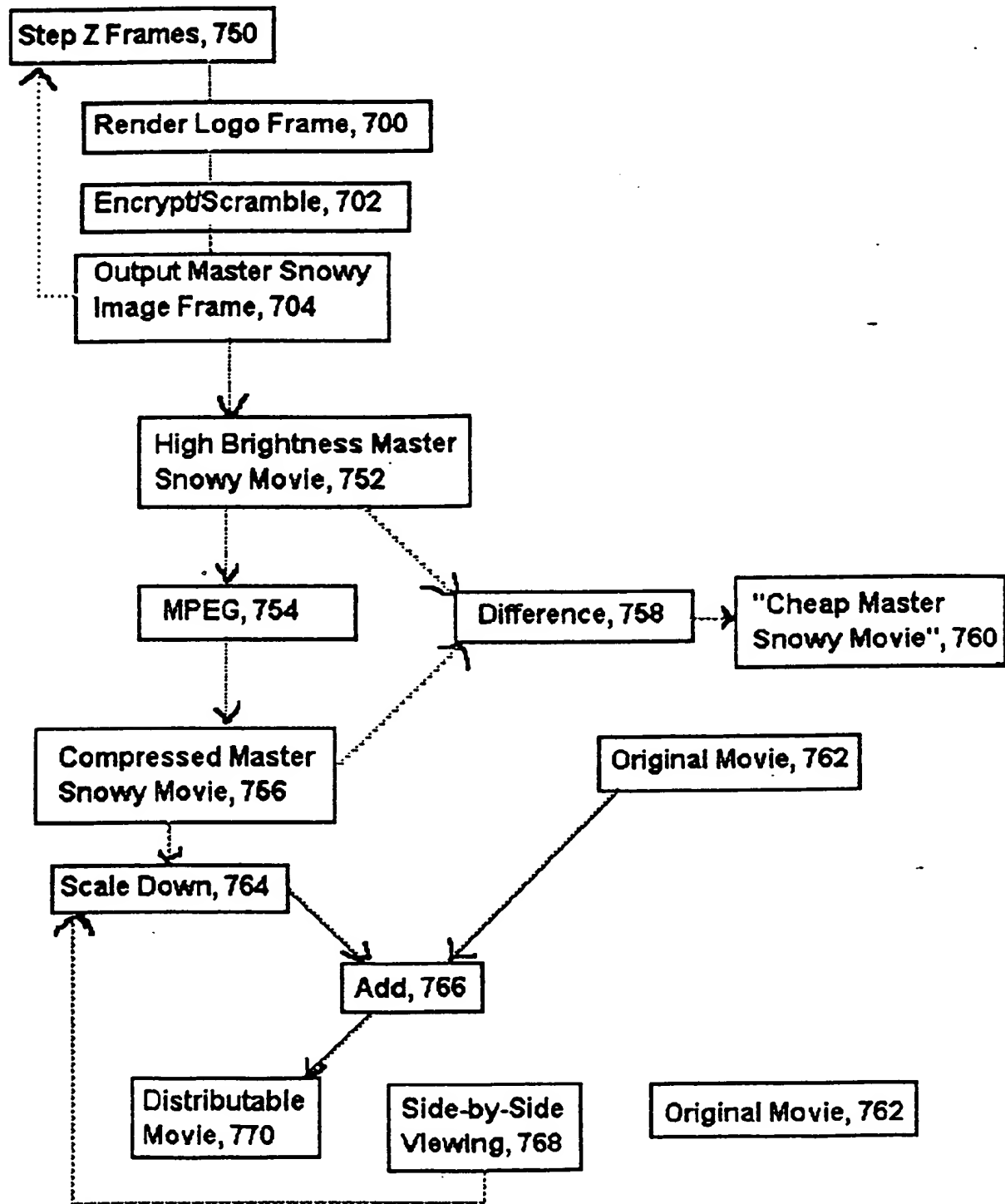


Figure 16

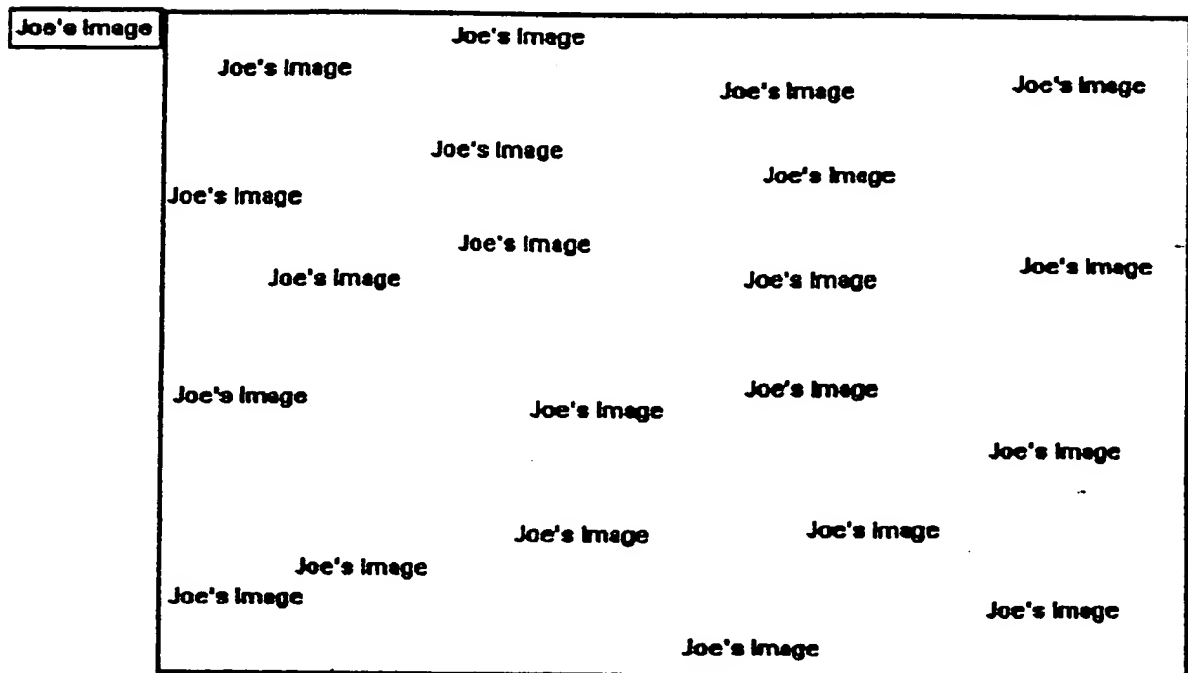
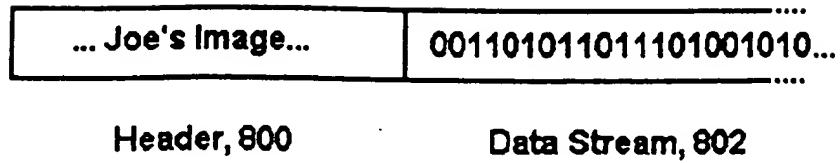
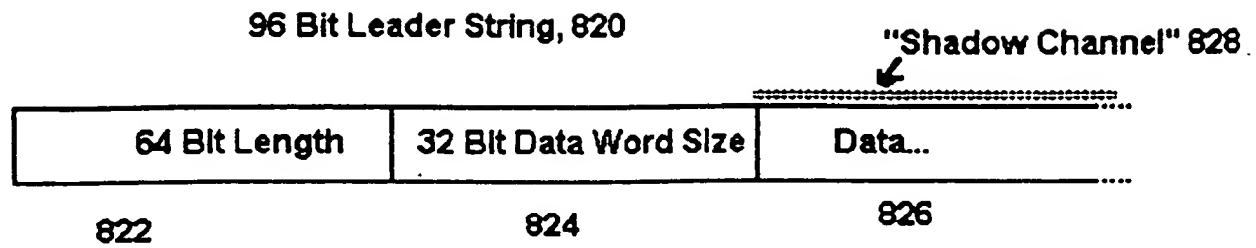
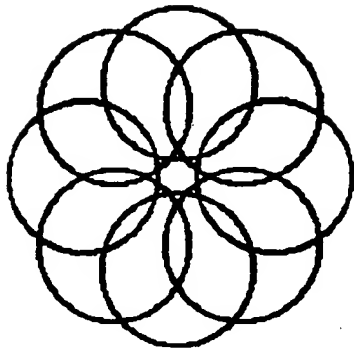


Figure 17

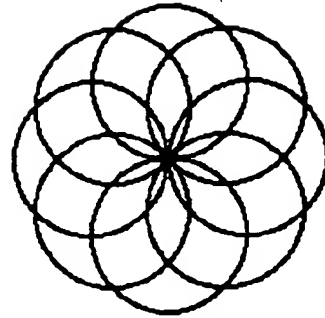


Universal Empirical Data Format

Figure 18



Supra-radial Knots, 850



Radial Knots, 852

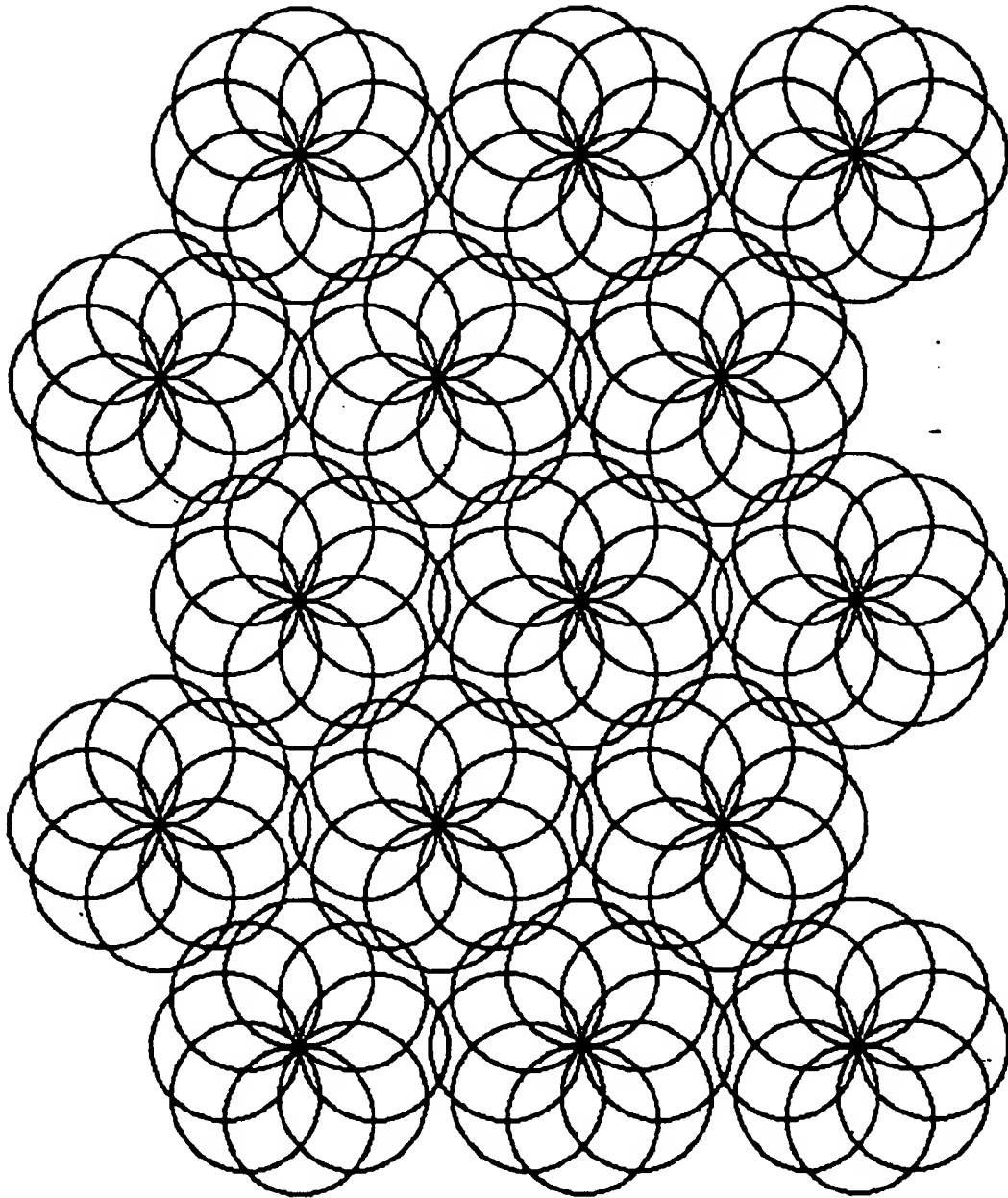


854, One basic concept of the knot is an overlapping of one strand of finite width over another strand



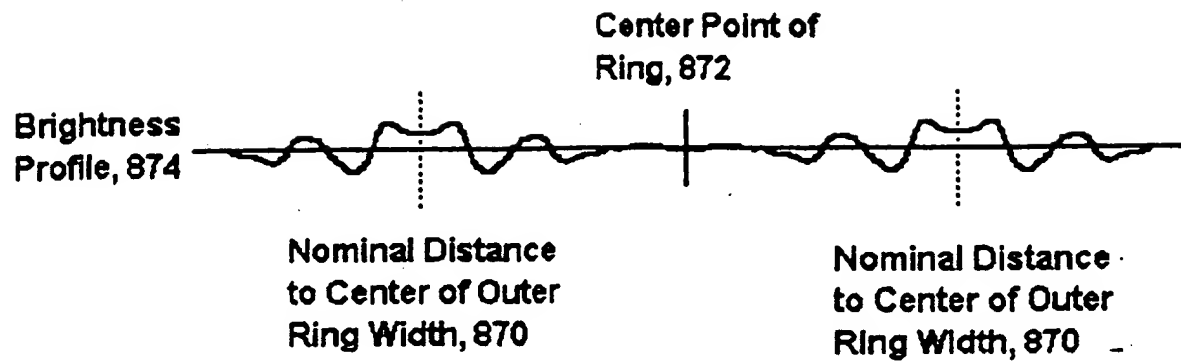
864, Another basic concept is the symmetric weaving of overlaps

Figure 19



**866, Quest for Mosaicd Knot Patterns which "Cover" and
are Coextensive with Original Image;
All elemental knot patterns can convey the same
information, such as a signature, or each can convey a
new message in a steganographic sense**

Figure 20



876, 2-D brightness of phase-only filtered ring is similar to the above brightness pattern rotated about central point of ring :

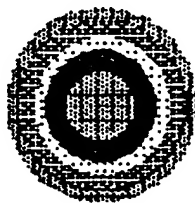


Figure 21 A

C	2C	C
2C	4C	2C
C	2C	C

where $C = 1/16$

Elementary Bump, 900
(Defined grouping of pixels with weight values)

2		3		4		5		6		7		0
6		7		0		1		2		3		4
					C	2C	C					
2		3		4	2C	4C	2C	6		7		0
					C	2C	C					
6		7		0		1		2		3		4

Example of how elementary bumps, 900, would be assigned locations in an image, and those locations would be associated with a corresponding bit plane in the N-bit word, here taken as $N=8$ with indexes of 0-7. One location, associated with bit plane "5", has the overlay of the bump profile depicted.

FIG. 21B

Figure 22

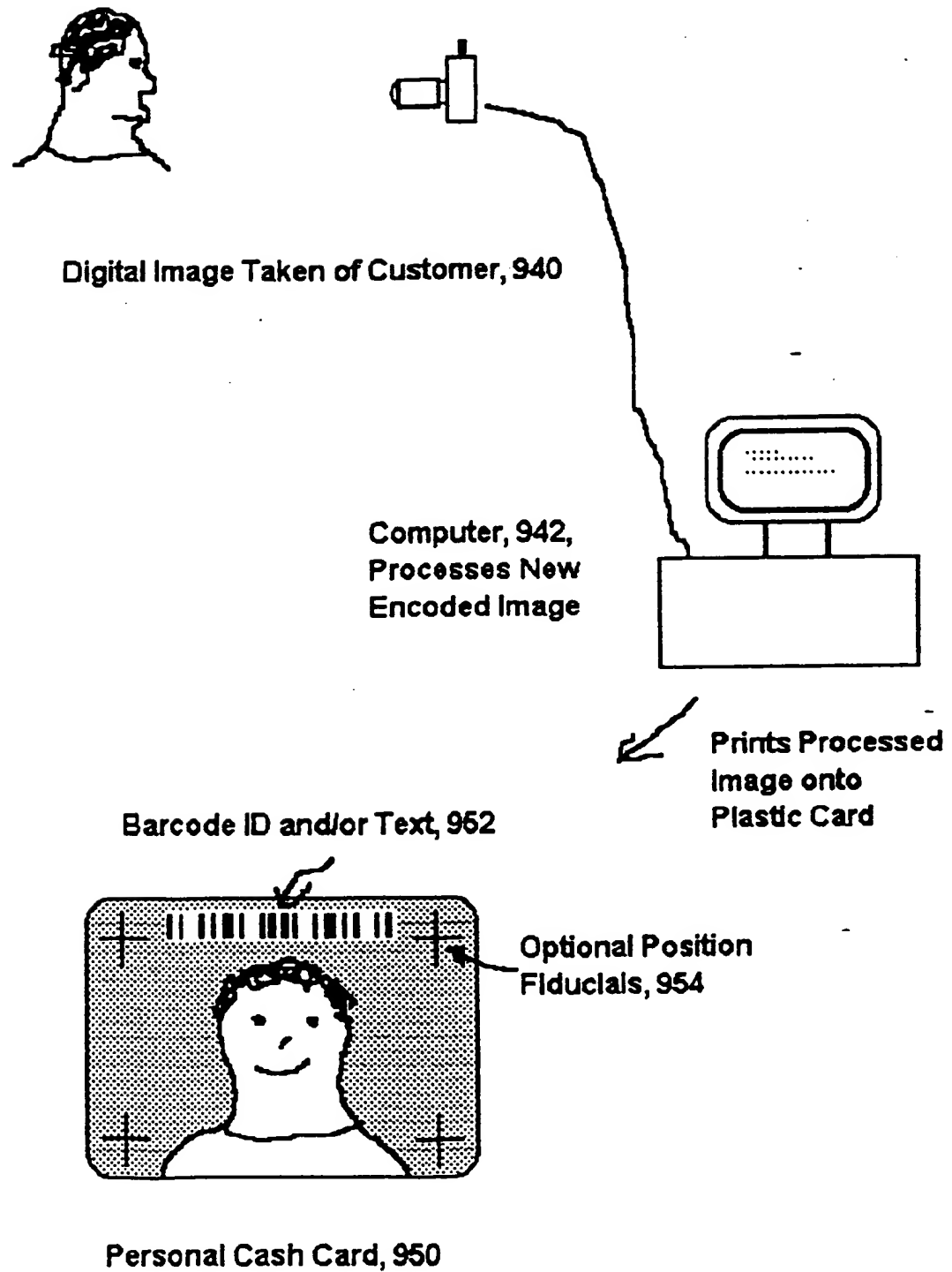
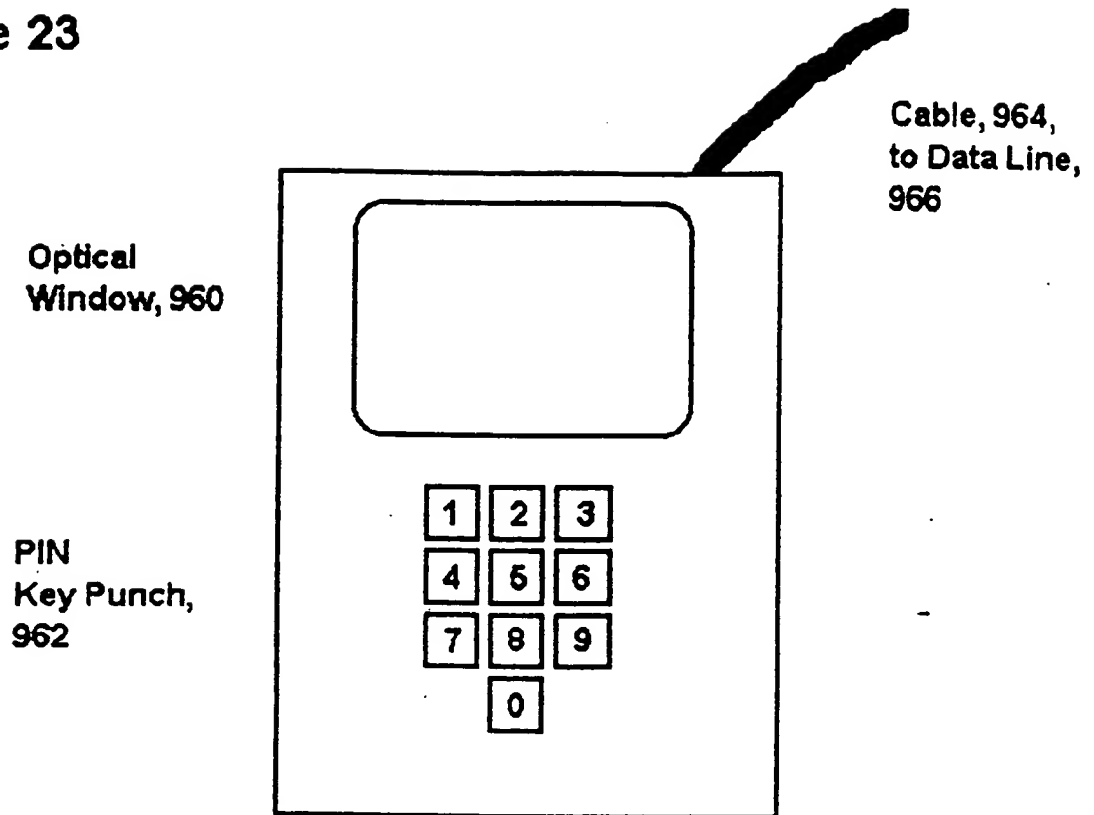


Figure 23



Low Cost Point-of-Sale Optical Reader, 958

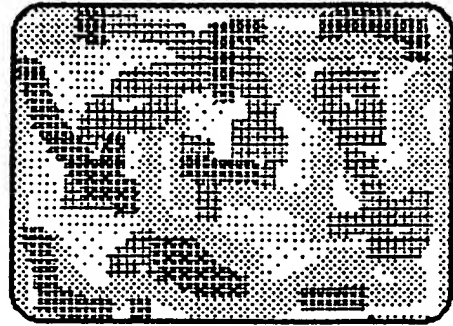
**Contains rudimentary optical scanner,
memory buffers, communications devices,
and microprocessor**

**Consumer merely places card into window and can, at their
pre-arranged option, either type in a Personal Identification
Number (PIN, for added security) or not. The transaction is
approved or disapproved within seconds.**

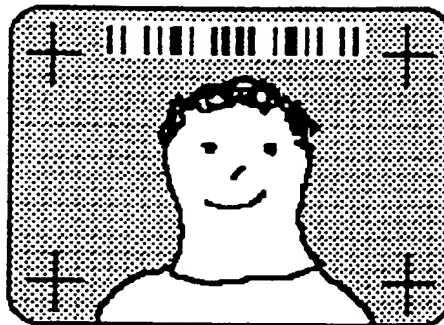
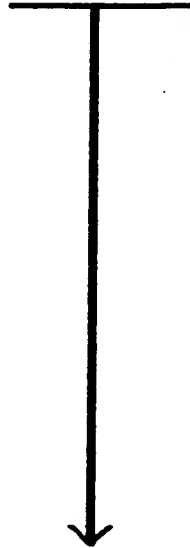
Figure 24



**Original Digital Image with
Barcode and Fiducials
Added, 970**



**Computer generates Master
Snowy Image 972, which is
generally orthogonal to
Original Image at left**



Combined to form Personal Cash Card, 950

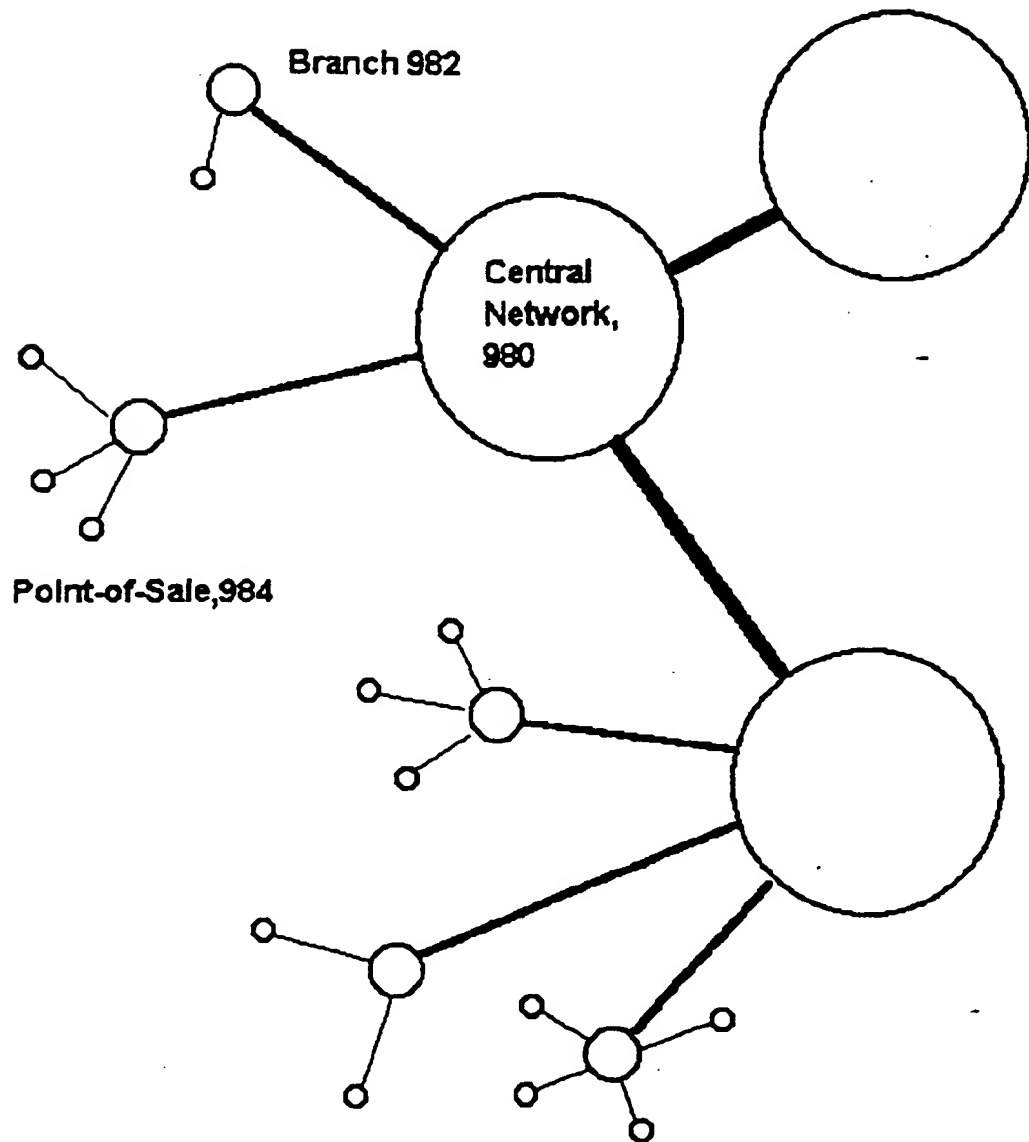
Figure 25

Typical Transaction Steps

- 1. Reader scans images on card, stores in memory, extracts persons ID**
- 2. Optional: User keys in PIN number**
- 3. Reader calls central account data network, handshakes**
- 4. Reader sends ID, (PIN), merchant information, and requested transaction amount to central network**
- 5. Central Network verifies ID, PIN, Merchant info, and account balance**
- 6. If OK, Central Network generates twenty four sets of sixteen distinct random numbers, where the random numbers are indexes to a set of 64K orthogonal spatial patterns**
- 7. Central Network transmits first OK, and the sets of random numbers**
- 8. Reader steps through the twenty four sets**
 - 8A. Reader adds together set of orthogonal patterns**
 - 8B. Reader performs dot product of resultant pattern and card scan, stores result**
- 9. Reader transmits the twenty four dot product results to Central Network**
- 10. Central Network checks results against master**
- 11. Central Network sends final approval or denial**
- 12. Central Network debits Merchant Account, credits Card account**

Figure 26

The Negligible-Fraud Cash Card System



A basic foundation of the cash card system is a 24 hour information network, where both the stations which create the physical cash cards, 950, and the point-of-sales, 984, are all hooked up to the same network continuously

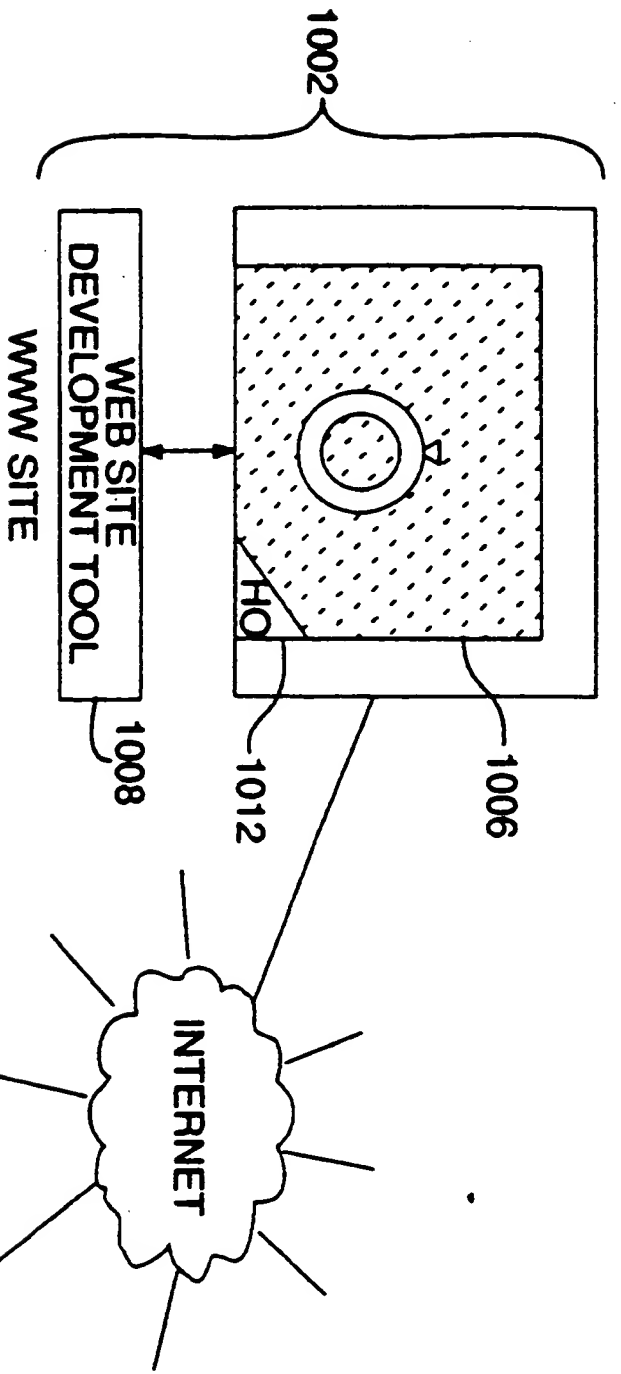


FIG. 27

Fig. 28

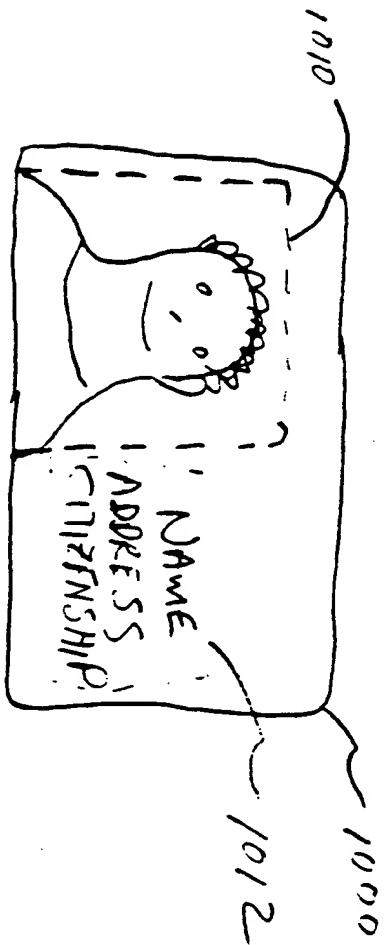
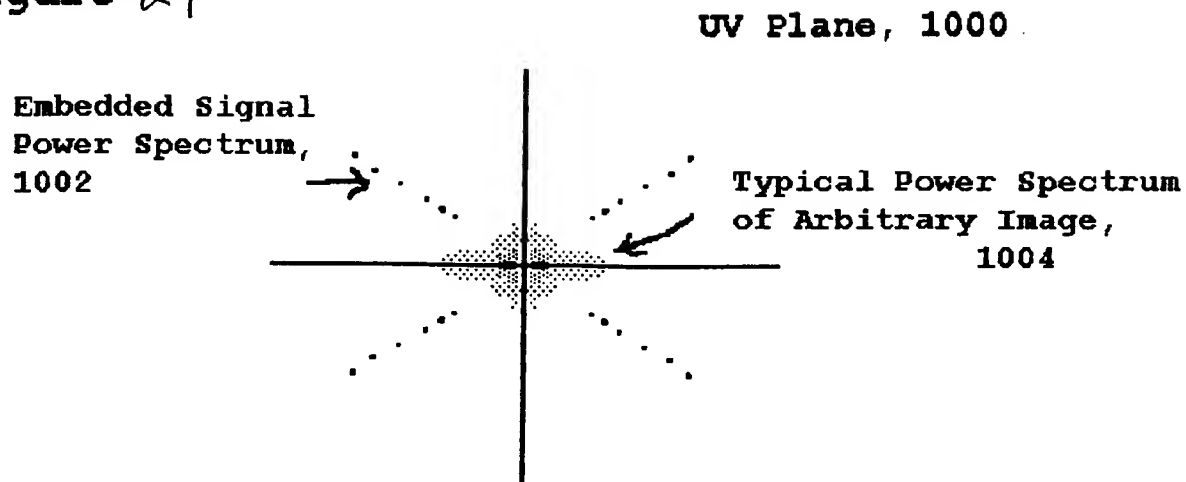
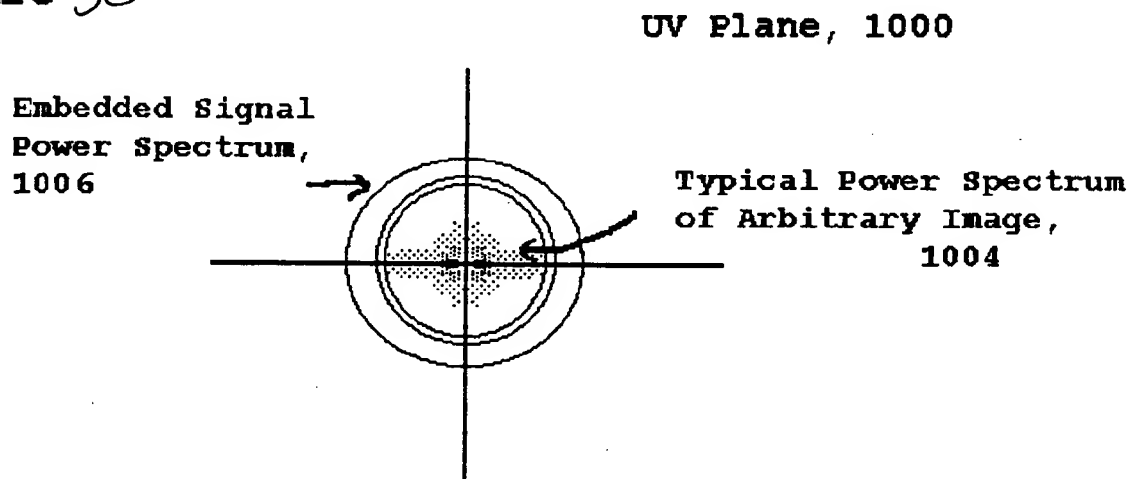


Figure 29



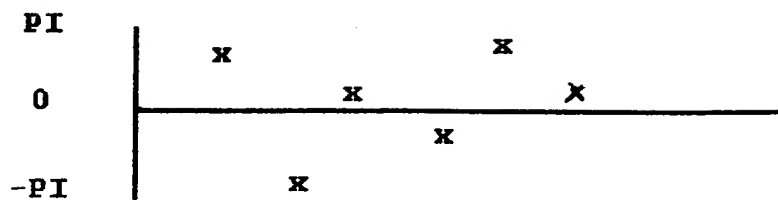
Non-harmonic spatial frequencies along the 45 degree axes, giving rise to a weave-like cross-hatching pattern in the spatial domain

Figure 30

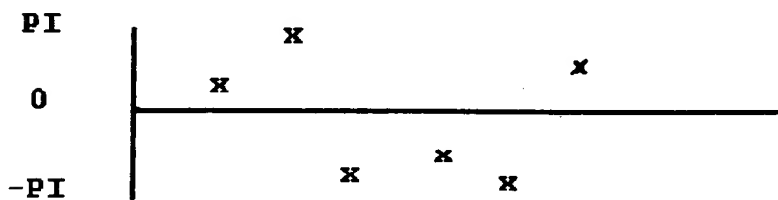


Non-harmonic concentric circles in UV plane, where phase hops quasi-randomly along each circle, giving rise to pseudo random looking patterns in the spatial domain

Figure 31A



Phase of spatial frequencies along forward 45 degree axes, 1008



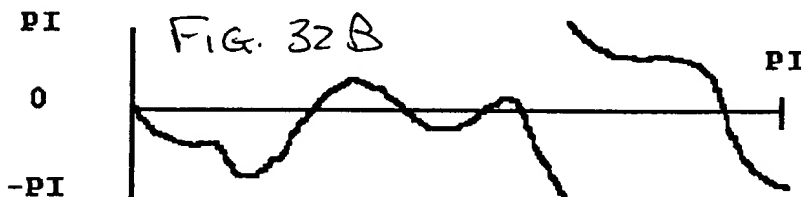
Phase of spatial frequencies along backward 45 degree axes, 1010

FIG. 31B

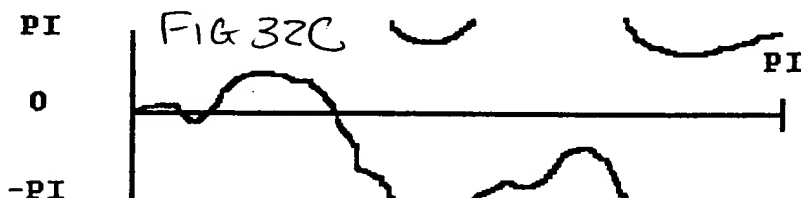
Figure 32A



Phase of spatial frequencies along first concentric ring, 1012

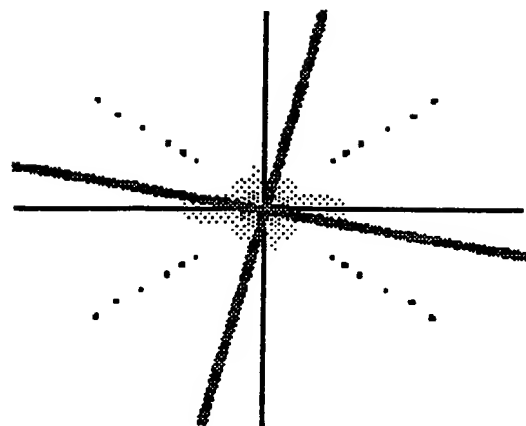


Phase of spatial frequencies along second concentric ring 1014



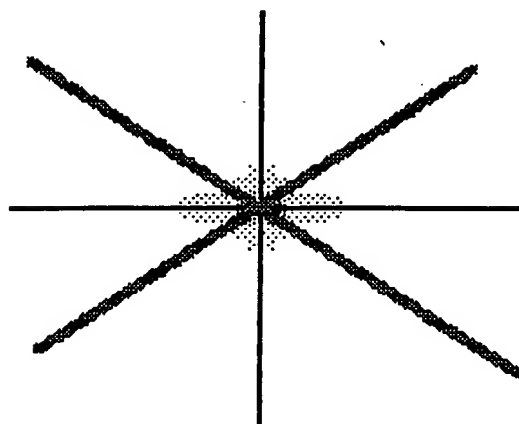
Phase of spatial frequencies along third concentric ring, 1016

Figure 33A



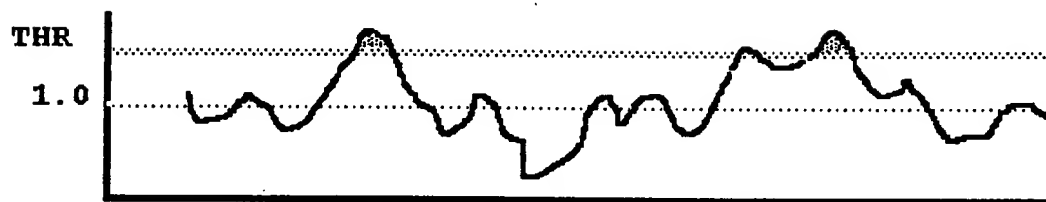
Angle A 1018

FIG. 33B



Angle B 1020

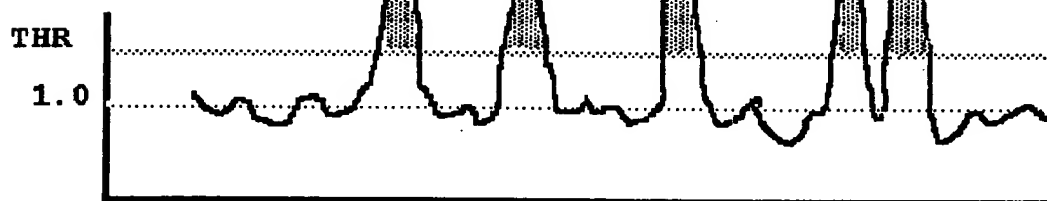
FIG. 33C



Power profile along Angle A, as normalized by its own moving average; only a minimal amount exceeds threshold, giving a small integrated value

1022

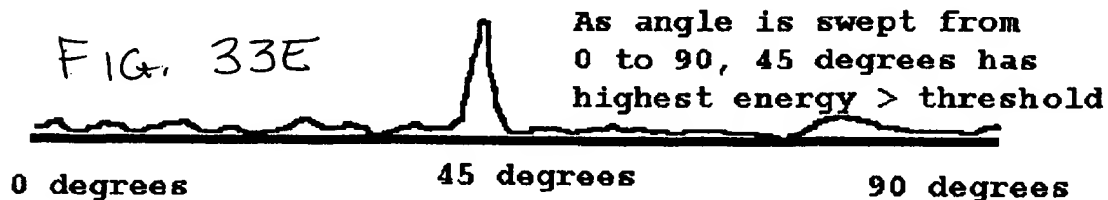
FIG. 33D



Power profile along Angle B, as normalized by its own moving average; this finds strong energy above the threshold

1024

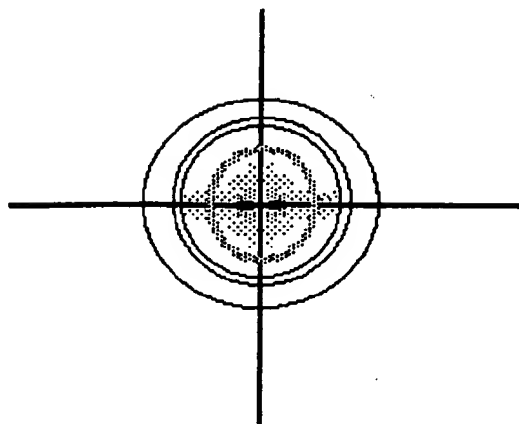
FIG. 33E



As angle is swept from 0 to 90, 45 degrees has highest energy > threshold

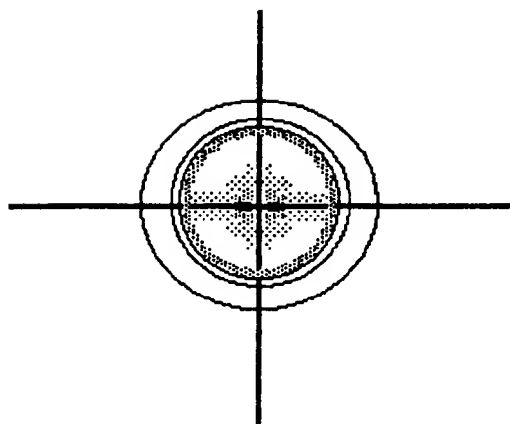
1026

Figure 34A



Radius A, 1028

Fig. 34B



Radius B, 1030

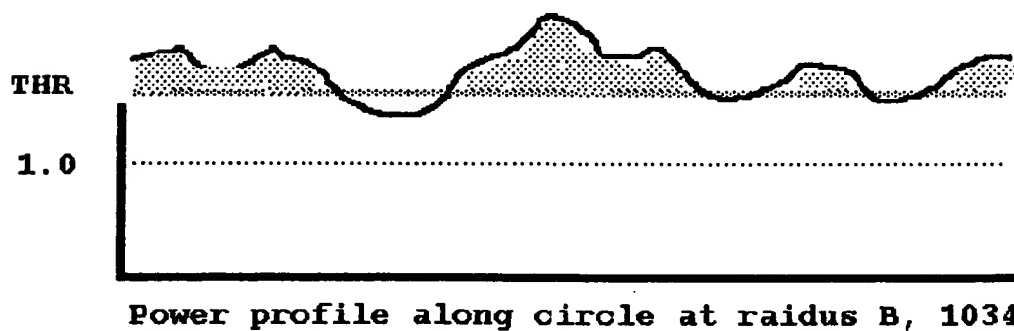
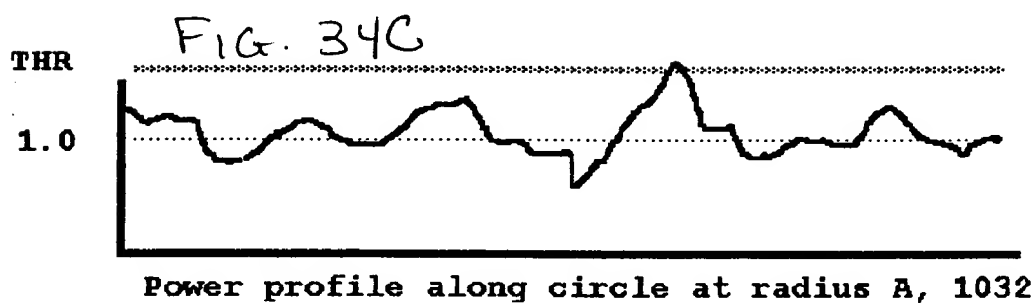


FIG 34D

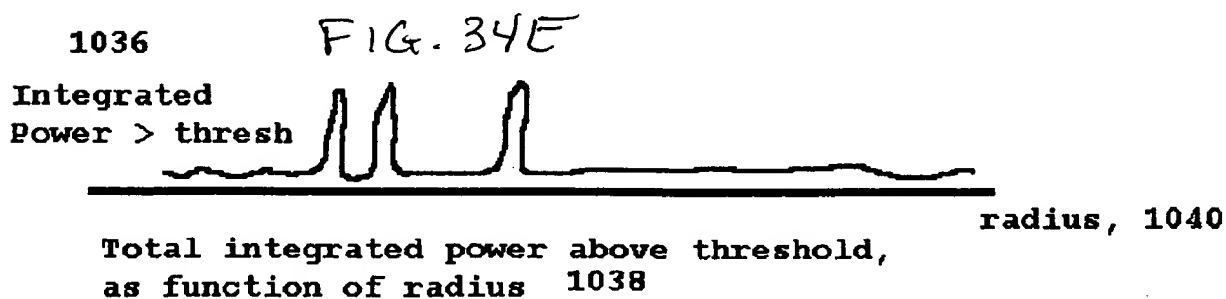
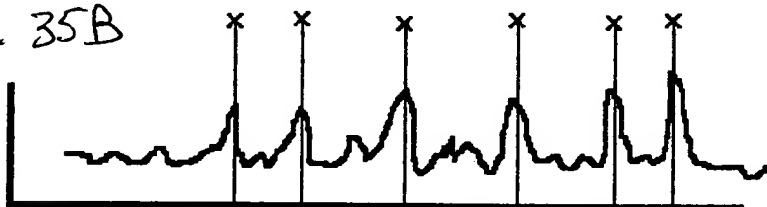


Figure 35A



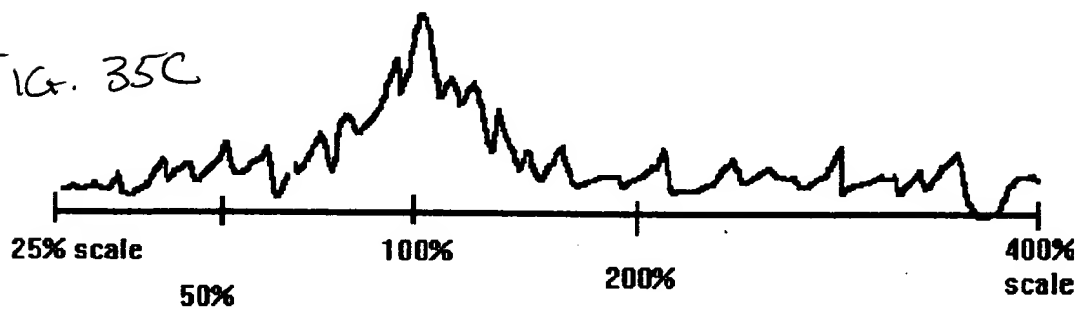
Scale = A; add all power values at the "known" frequencies, 1042

FIG. 35B



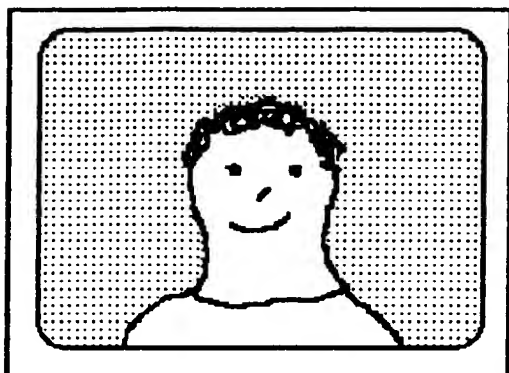
Scale = B; add all power values at the "known frequencies, 1044

FIG. 35C



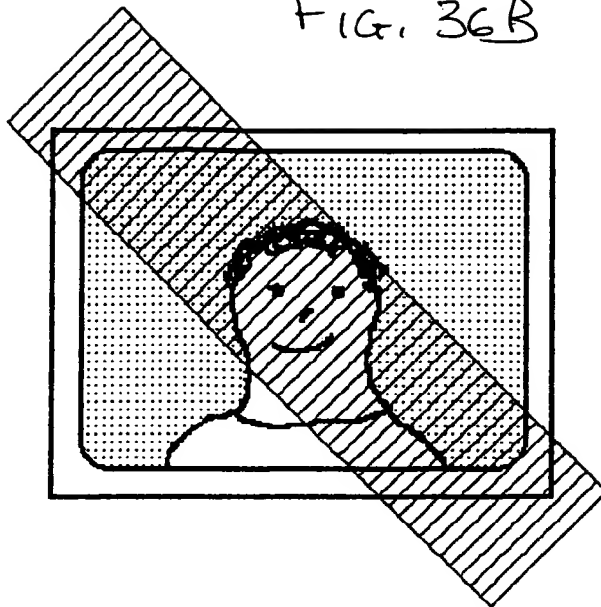
"Scaled-kernel" based matched filter; peak is where the scale of the subliminal grid was found, 1046

Figure 36A



Arbitrary Original Image, 1050,
in which subliminal
graticules may have been placed

FIG. 36B



"Column scan", 1052
is applied along a
given angle through
the center of the
image

Column-
integrated
grey
values,
1054

FIG. 36C



FIG. 36D



Magnitude of Fourier Transform of scan data,
1060